OCTOBER 2019 Update

Small Cells Forecast

Major changes to the forecast this quarter include:

1. The overall Small Cell market forecast has been adjusted slightly down based on early indications from chipset suppliers of slight demand pullback in China as China Unicom and China Telecom assess a possible 5G RAN co-investment. Also, the trade tension between China and the USA may impact supply chain constraints to Huawei and ZTE, the two main suppliers of Carrier Indoor small cells in China.

2. While the near-term supply-demand disruption will be temporary, the overall small cell shipment forecast is heavily skewed by what happens in China and will have a material impact on the overall market. Excluding residential femtocells, the Small Cell market is expected to grow at 10% CAGR in unit shipments and 9% CAGR in revenue terms over the next five years.

3. The Enterprise small cell segment is expected to see a higher share of split-baseband RRH configuration as developments from O-RAN standardization offers baseband alternatives for the growing Private LTE segment of the market.

4. The Carrier Indoor segment continues to experience very robust growth, especially in China as the operators continue to densify and "digitize" indoor spaces with DRS deployments in concert with 5G macro buildout. We have significantly revised 5G DRS unit shipment share upward in 2019 based on significant volume ramp reported from two primary DRS vendors in China: Huawei and ZTE.

5. We have raised our O-RAN carrier indoor shipment in 2019 based on the latest intelligence from China. It appears that the Chinese operators are showing a greater interest of sourcing Carrier Indoor radio units from Tier 2 vendors leveraging their work in the O-RAN space.

6. The Carrier Outdoor segment has not changed much. We expect operators to deploy both low-power RRH for network densification and high-power "mini macro" radios to extend coverage/capacity in "hotspot" areas in urban areas and mobile coverage extension in rural areas. While tier 1 operators mainly focus their CAPEX investment on 5G macro-layer in the early days of the 5G transition, the (sub-6 GHz) Carrier Outdoor deployment will remain primarily on LTE for the next several years.

7. In North America, we observed steady operator activities around small cell deployments – still requiring 1-2 year deployment cycle for site acquisition, power infrastructure planning, small cell deployment, etc. While the T-Mobile/Sprint merger "saga" continues to play out in the regulatory circles, Sprint continues to deploy small cells in strategic locations, and we

expect this trend to continue for at least a year after the close of the merger. Moreover, Verizon continues its C-RAN focused network densification deployment, including CBRS high-power radios. Despite press releases centering on 5G millimeter wave deployments, we see operators leveraging both outdoor and indoor deployments for capacity augmentation. We expect that one or two major cable operators to jump into action in RAN deployments in 2020 and beyond.

8. In China, most of the small cell action evolves around DRS deployments. While the major Chinese OEMs, Huawei and ZTE, are forecasting robust carrier deployments of LTE and 5G DRS units in major cities, our sources in the semiconductor space are reporting demand pull back. We have significantly adjusted the 5G DRS shipments upward based on the latest intelligence. We expect tier 2 OEMs including Comba, Datang, and others to participate in Carrier Indoor deployments as the operators look to vendor alternatives to expand and densify 5G network deployments that they are planning.